Central-Box

User's Manual

PHOTOVOLTAIK-TECHNIK
PADCON
Future technologies.

Edition 4.0

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Documentation History

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Edition 4.0
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1. Introduction

1.1 Usage

The PADCON Central-Box is an array combiner used as a device for collecting of the individual supply lines from the TGA boxes of the photovoltaic plant. The DC supply lines collected in the Central-Box are led to the inverter via a collecting main.

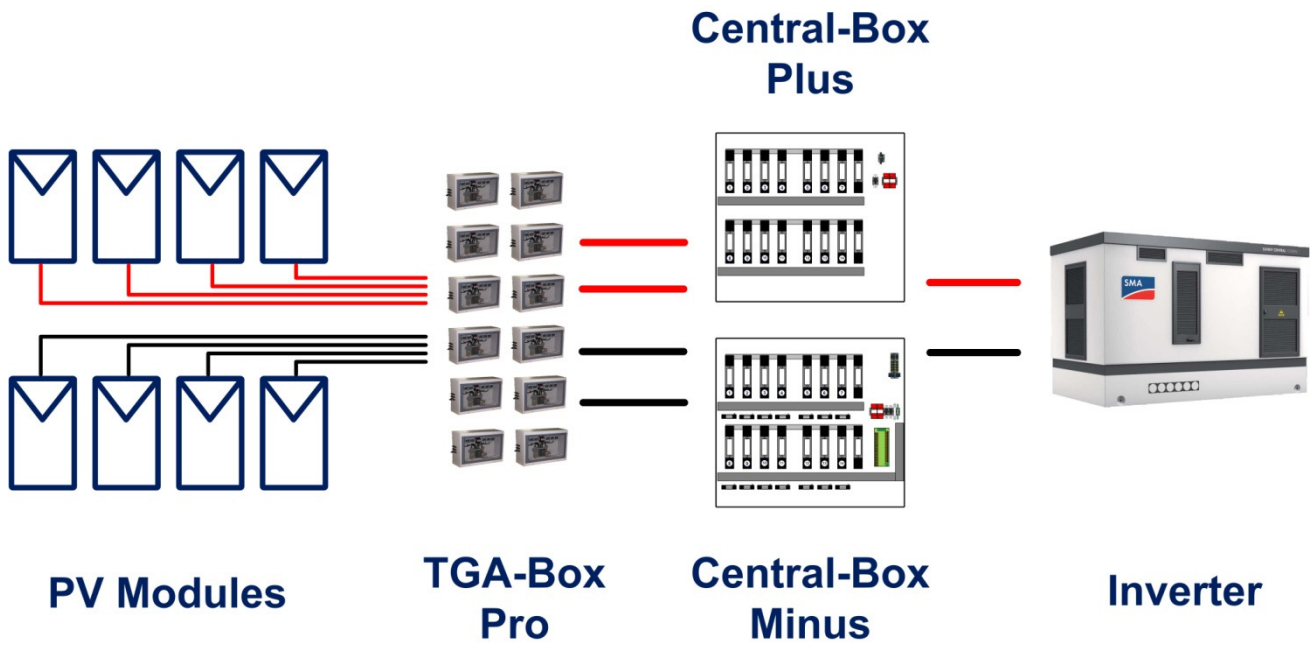


Figure 1: Central-Box - Overview

The Central-Box is always mounted in pairs, in each case one box for plus and minus, to guarantee a safe build-up.
The consequent focusing of the construction for durability is reflected in the clear layout, the use of high quality components and the specific design for outdoor operation.
Padcon optionally offers the RealTime monitoring system for the Central-Box.

There are two types of the Central-Box, the Central-Box Plus and the Central-Box Minus. The Central-Box **Plus** is used for collecting up to 14 Plus supply lines from the TGA-Boxes. The Central-Box **Minus** is used for collecting up to 14 Minus supply lines from the TGA-Boxes.
Additional the voltage of the collecting mains is monitored in the Central-Box **Plus**. As well the voltage of the collecting mains as the current of the supply lines coming from the TGA-Boxes are monitored in the Central-Box **Minus.**

Central-Box Plus

- The Plus supply lines from the TGA-Boxes are collected in the Central-Box Plus.
- Up to 14 DC supply lines can be attached in the Central-Box Plus.
- The supply lines are fused by NH1 fuse links.

- The supply lines are protected against surge voltage.
- The voltage of the collecting mains is monitored.

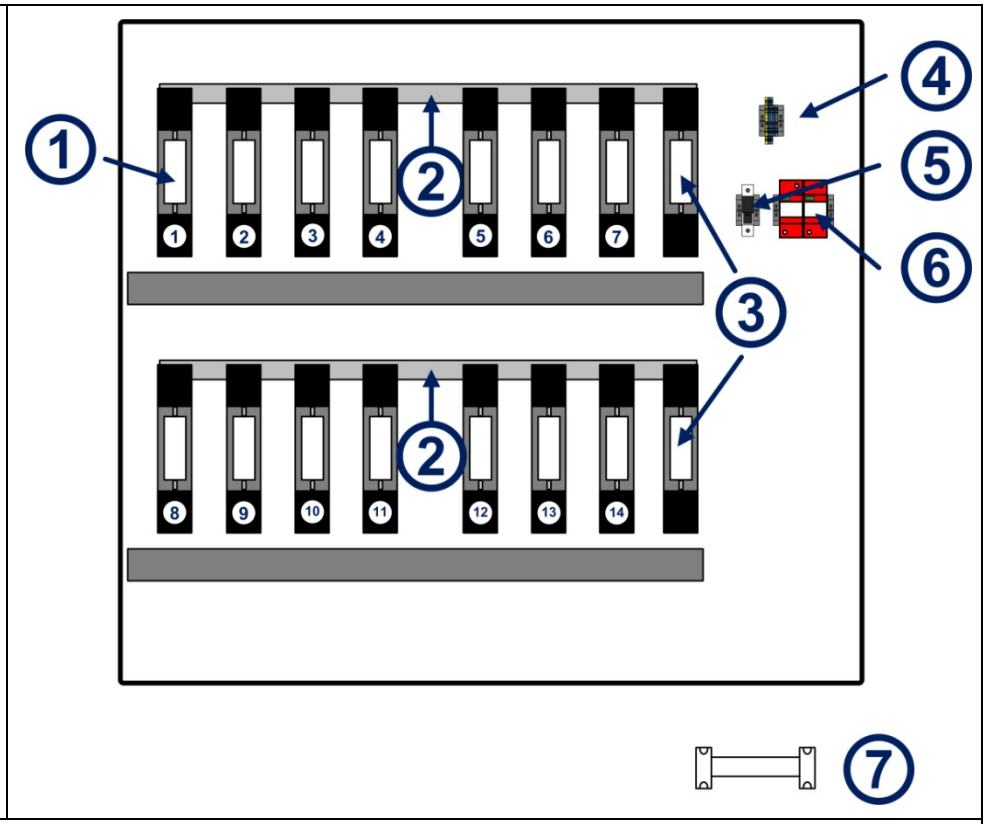
Central-Box Minus (with current and voltage monitoring)

- The Minus supply lines from the TGA-Boxes are collected in the Central-Box Minus.
- Up to 14 DC supply lines can be attached in the Central-Box Minus.
- The supply lines are fused by NH1 fuse links.
- The supply lines are protected against surge voltage.
- The current of the 14 supply lines is monitored.
- The voltage of the collecting mains is monitored.

2. Product description / Delivery contents

2.1 Overview of the Central-Box Plus

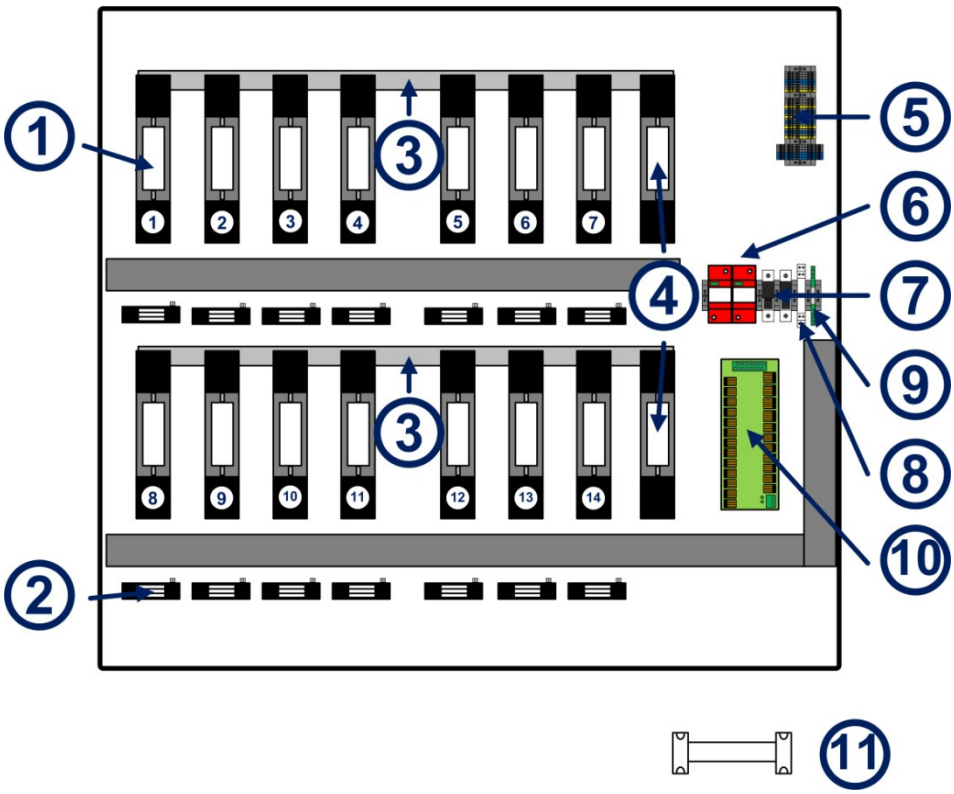
Central-Box Plus - Components



Cypher	Number	Description
①	14	NH1 fuses for the individual plus strings.
②	2	Collecting mains.
③	2	Fuses for the surge voltage arresters.
④	1	Terminal block for the surge arrester monitoring.
⑤	1	Fuse for the voltage monitoring line to the Central-Box Minus.
⑥	2	Surge arresters for the DC supply lines.
⑦	1	Bus bar for the PE connections. Placed in the Central-Box Plus base.

Table 1: Central-Box Plus - Components

Central-Box Minus - Components



Cypher	Number	Description
①	14	NH1 fuses for the individual minus strings.
②	14	Current converters for the individual minus string current measurement.
③	2	Collecting mains.
④	2	Fuses for the surge voltage arresters.
⑤	1	Terminal block: surge arrester monitoring and the connection of the different sensors (irradiation, temperature, etc.).
⑥	2	Surge arresters for the DC supply lines.
⑦	2	Fuses for the voltage monitoring line to the Central-Box Plus.
⑧	1	Voltage converter for the string voltage measurement.
⑨	1	3 way isolation amplifier: 4-20 mA -> 0-10 V
⑩	1	Adapter board for the DC string currents and the DC voltage measurement and additional free available analog inputs.
⑪	1	Bus bar for the PE connections. Placed in the Central-Box Minus base.

Table 2: Central-Box Minus - Components

2.3 Delivery contents

- Central-Box
- User's Manual
- 14 NH1 fuses

3. Technical data and documents

3.1 Specifications

HOUSING	
Open field installation	Yes
UV resistance	Yes
Material	Fiber glass reinforced polyester
Properties	High flame resistance, weatherproof
Coloring	RAL 7035
Mounting	On foundation base
INPUT VALUES	
Max. valid DC voltage ($U_{DC\ Max}$)	≤ 1000 V
Number of DC inputs per box	max. 14
String connection	Cable lug M10
Fuse	63A – 250A
Max. valid DC current (I_{Max})	140 A
OUTPUT VALUES	
Main connection	Cable lug M12
Number of DC outputs	2
Max. output current ($I_{DC\ tot}$)	max. 2 x 540A
Protective conductor connection	16 mm² - 120 mm²
DIMENSIONS AND WEIGHT	
Cabinet: Width/Height/Depth [mm]	1115 / 1100 / 327
Base: Width/Height/Depth [mm]	1115 / 902 / 310
Weight	ca. 80 kg (depends on configuration)
STANDARDS	
CE conformity	Yes
PROTECTIVE CLASS AND ENVIRONMENTAL CONDITIONS	
Protection class conforming to EN 60529	IP 44
Valid surrounding temperature (T in °C)	-25 °C…+40 °C
Rel. air humidity non condensing (U_{Air})	up to max. 90%
Max. height above mean sea level (MSL)	1.000 m
FURTHER PROPERTIES	
Over voltage protection	Type 2, (Type 1 optional)
Monitoring	Current and voltage (optional)

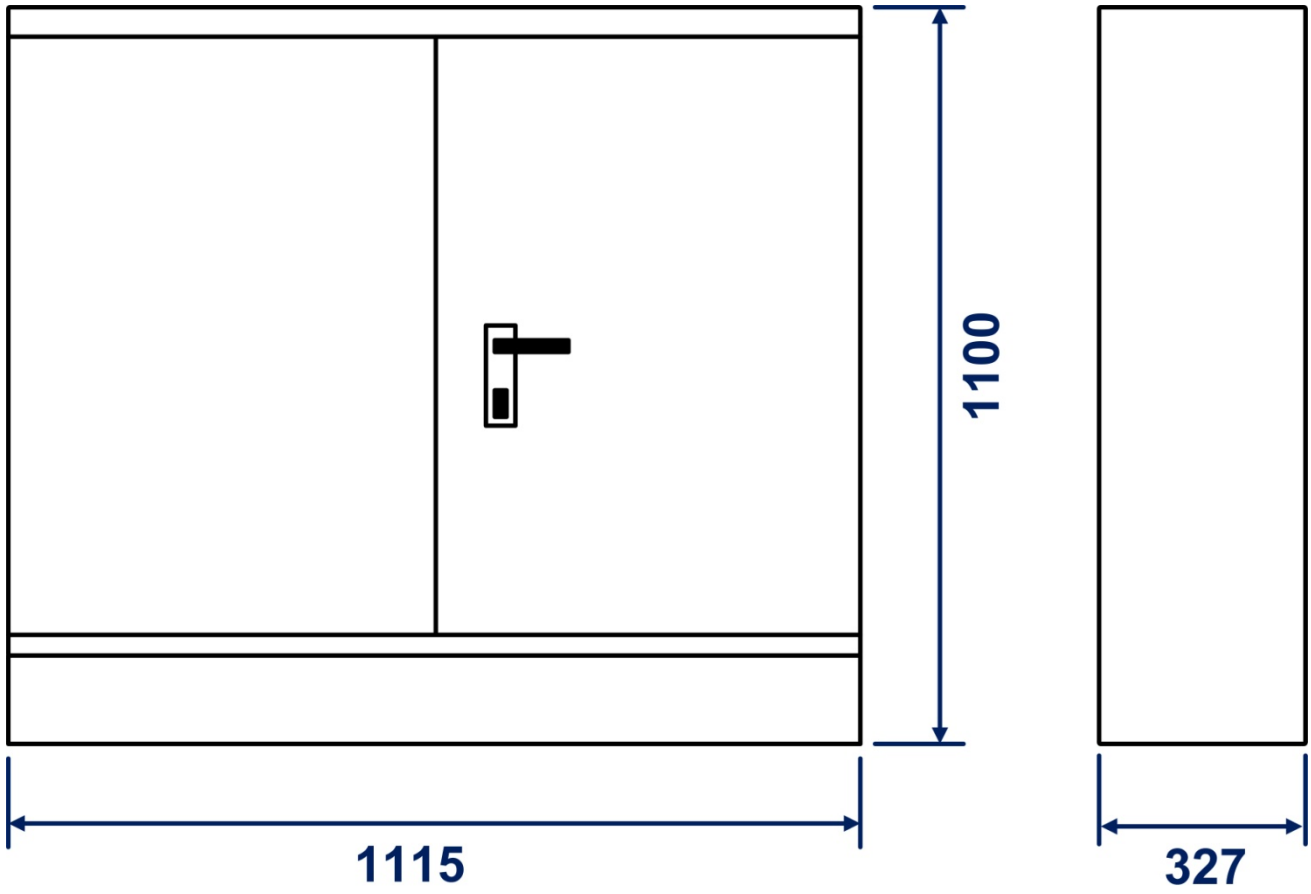


Figure 2: Cabinet dimensions

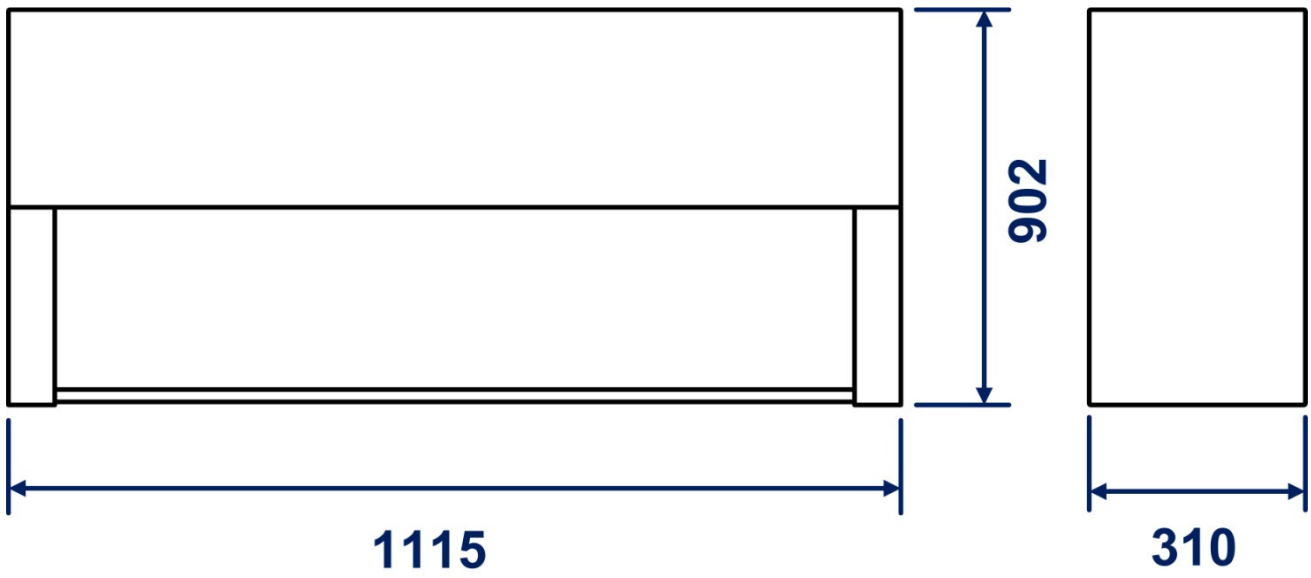


Figure 3: Base dimensions

4. Installation / Connection

Danger:
Danger to life by electric shock !

High DC voltages are applied to different components of the Central-Box:

- All operations described in this chapter excludedly may be led through by qualified technical personal. Qualified means that the personal is trained appropriately to the task.
- All safety notes mentioned in the user's manual have to be observed during operations at the Central-Box.
- If you are not able to remove an error with help of this manual, please immediately contact PADCON.

4.1 Installation

4.1.1 Place of installation

- Easily accessible.
- Connections have to be accessible.
- No constraining objects in immediate surrounding.
- Allow possibility for yearly maintenance (mowing the lawn, cleaning housings,…).

4.1.2 No direct weather influence

- Avoid direct, strong sun irradiation.
- Protect against direct rain.
- Protect against standing water.

4.1.3 Cable connection

- Outputs on the side.
- Inputs at the bottom.
- Observe correct string assignment.
- Retighten cable glands.

4.1.4 Installation of the housing

- Mount housing tension free.
- Avoid mechanical tension by screws.
- Adjust mechanical tensions with buffers if necessary.

4.1.5 Mechanical installation of the Central-Box

- Solid and even mounting surface.
- Observe complete rest of the flange area of the optional available mounting brackets.
- Use all four fastening screws.

4.1.6 Horizontal mounting

- Check mounting and repair if necessary.

4.1.7 Realize drip off loop for inputs

- Imply reserve.
- No horizontal cable routing.

4.1.8 Cable conduct

- Avoid mechanical tension of inputs.
- Conduct cables without mechanical tension.
- Avoid crossings in wiring.

4.2 Installation

1. Disconnect the inverter on the AC side.
2. Switch the inverter currentless on the DC side.
3. Mount the Central-Box.
4. Connect the protective earth conductor.
5. Connect the inputs of the Central-Box.
5. Connect the outputs of the Central-Box with the inverter.
6. Switch on the current on the DC side.
7. Put the inverter into operation.
8. We recommend to check the polarity and height of voltage of the strings before installation and to calibrate the input values of the inverter after installation.

Danger:
The five safety rules !

The five safety rules:

- Disconnect
- Secure against restart
- Check absence of voltage
- Earth and short circuit
- Fence off and cover adjacent, live parts

4.3.1 Connection of the Central-Box Plus

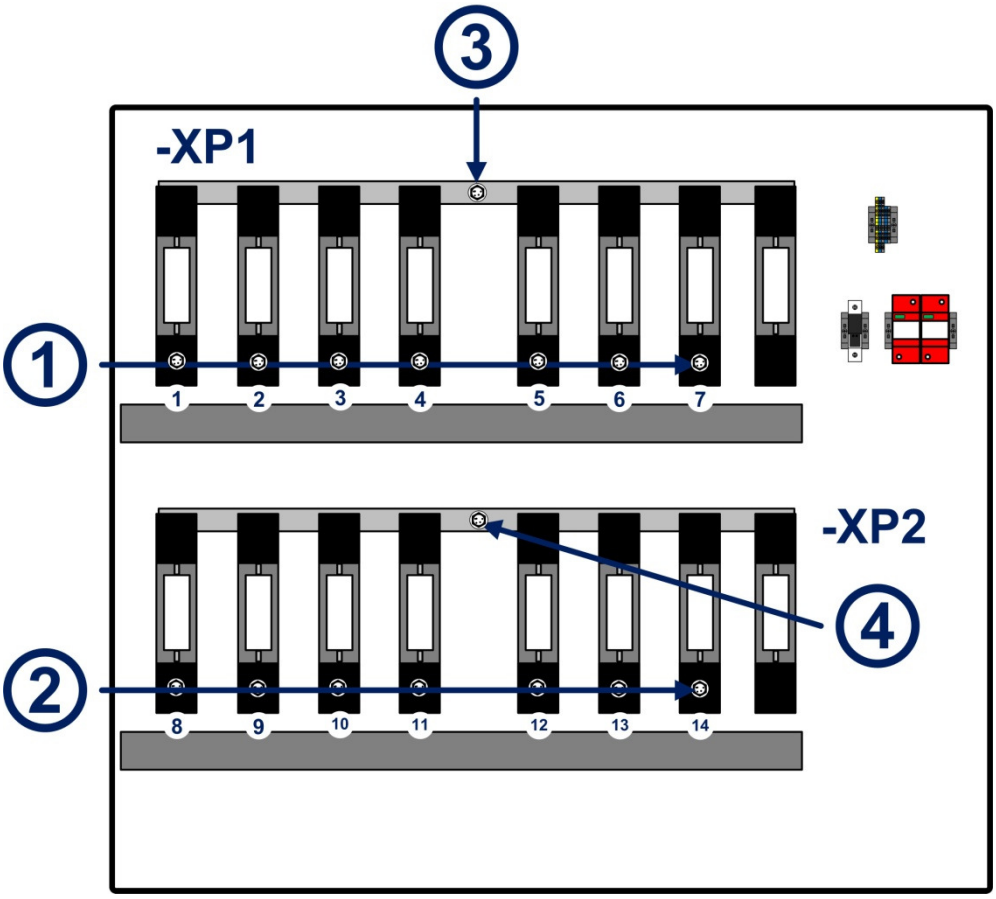


Figure 4: Central-Box Plus – Connection 1

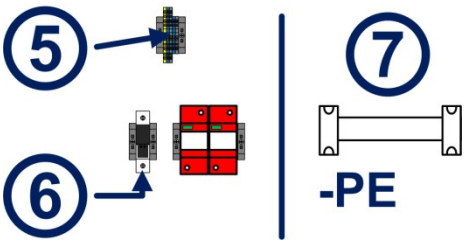


Figure 5: Central-Box Plus – Connection 2

Central-Box Plus – terminal description	
①	**String supply lines to the NH1 fuses of –WP1**
Screw connection	**Signal description**
1 to 7	String supply lines 1 to 7
②	**String supply lines to the NH1 fuses of –WP2**
Screw connection	**Signal description**
8 to 14	String supply lines 8 to 14
③	**Collecting main of –WP1**
Screw connection	**Signal description**
1	Collecting main of –WP1
④	**Collecting main of –WP2**
Screw connection	**Signal description**
1	Collecting main of –WP2
⑤	**Surge arrester communication: -X0**
Spring terminal	**Signal description**
1	Remote signal: contact 1 (noc)
2	Remote signal: contact 2 (noc)
⑥	**Voltage measurement to Central-Box Minus: -F1C**
Screw terminal	**Signal description**
1	Central-Box Plus is connected with Central-Box Minus for the voltage measurement. This connection is established between the fuse –F1C of the Central-Box Plus and the fuse –F2C of the Central-Box Minus. At this point here the connection for the Central-Box Plus is attached to the screw terminal of fuse –F1C.
⑦	**PE bus bar (in the Central-Box base)**
Screw terminal	**Signal description**
1 to 10	Up to 10 screw terminals can be sticked to the PE bus bar for the necessary PE connections.

Table 3: Central-Box Plus – Terminal description

Note:
Observe tightening torque !

The torque of the individual lines mentioned below has to be observed during connection.

Cable cross sections and torques				
Line	**Connection type**	**Cross section**	**Thread diameter**	**Torque**
Supply line	Screw connection	16 – 95 mm^2	M10	25 Nm
Collecting main	Screw connection	16 - 120 mm^2	M12	32 Nm
Protective conductor	Screw terminal	16 – 120 mm^2	M10	32 Nm
Control and communication lines	Spring terminal	0,75 – 2,5 mm^2	-	-

Table 4: Central-Box – Cable cross sections and torques

4.3.2 Connection of the Central-Box Minus

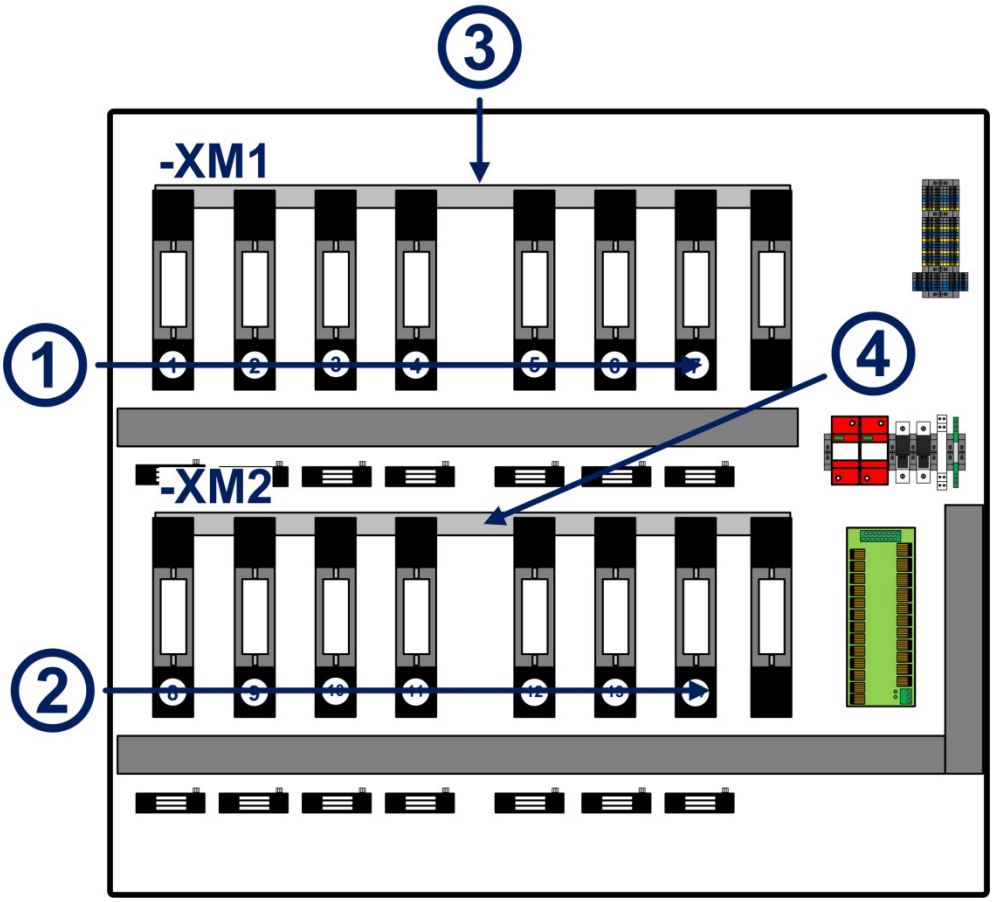


Figure 6: Central-Box Minus – Connection 1

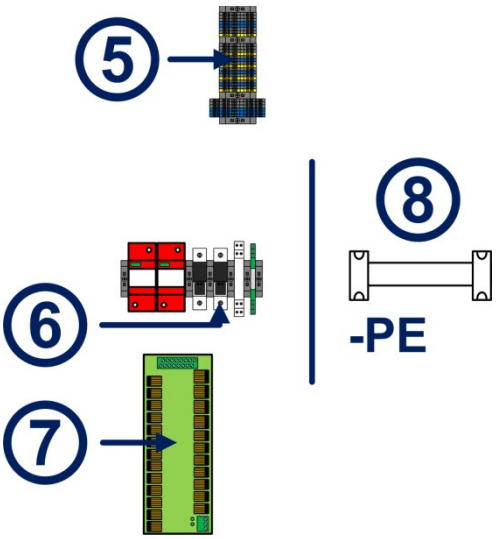


Figure 7: Central-Box Minus – Connection 2

Central-Box Minus – terminal description

① String supply lines to the NH1 fuses of –WM1

Screw connection	Signal description
1 to 7	String supply lines 1 to 7

② String supply lines to the NH1 fuses of –WM2

Screw connection	Signal description
8 to 14	String supply lines 8 to 14

③ Collecting main of –WM1

Screw connection	Signal description
1	Collecting main of –WM1

④ Collecting main of –WM2

Screw connection	Signal description
1	Collecting main of –WM2

⑤ Terminal block

-X1 – Surge arrester monitoring

Spring terminal	Signal description
1	Surge arrester monitoring: contact 1 (ncc)
2	Surge arrester monitoring: contact 2 (ncc)
-15V	Power supply
0V	Power supply
0V	Power supply
+15V	Power supply
24V	Power supply
PE	Protective earth

-X2 – Sensors (irradiation, temperature, etc.)

Spring terminal	Signal description
21	3 way isolation amplifier: 4-20 mA -> 0-10 V: minus input
22	3 way isolation amplifier: 4-20 mA -> 0-10 V: plus input
2	3 way isolation amplifier: 4-20 mA -> 0-10 V: measuring signal
PE	Protective earth
24V	Sensor 3: Power supply
0V	Sensor 3: Power supply
3	Sensor 3: measuring signal
PE	Protective earth
24V	Sensor 4: Power supply
0V	Sensor 4: Power supply
4	Sensor 4: measuring signal
PE	Protective earth
24V	Sensor 5: Power supply
0V	Sensor 5: Power supply
4	Sensor 5: measuring signal

PE	Protective earth

-X3 – Power supply

Spring terminal	Signal description
24V	Power supply
24V	Power supply
24V	Power supply
0V	Power supply
0V	Power supply
0V	Power supply

⑥ Voltage measurement to Central-Box Plus: -F1C

Screw terminal	Signal description
1	Central-Box Plus is connected with Central-Box Minus for the voltage measurement. This connection is established between the fuses –F1C of the Central-Box Plus and the fuse –F2C of the Central-Box Minus. At this point here the connection for the Central-Box Minus is attached to the screw terminal of fuse –F2C.

⑦ Voltage / current converter - Adapter board PSC 1.1

-X1 – Power supply

Screw terminal	Signal description
1	0V power supply
2	+15V power supply
3	-15V power supply

-X2 – Analog inputs for free use

Screw terminal	Signal description
1	0V potential for analog inputs.
2	0V potential for analog inputs.
3	0V potential for analog inputs.
4	0V potential for analog inputs.
5	0V potential for analog inputs.
6	0V potential for analog inputs.
7	0V potential for analog inputs.
8	0V potential for analog inputs.
9	Analog input 1: freely available.
10	Analog input 2: freely available.
11	Analog input 3: freely available.
12	Analog input 4: freely available.
13	Analog input 5: freely available.
14	Analog input 6: freely available.
15	Analog input 7: freely available.
16	Analog input 8: freely available.

-X3 (RJ45) – Analog inputs for the current converter evaluation for string current measurement

Pin	Signal description
1	0V potential for the analog signals of the converters for string current measurement.
2	Current converter at supply line 1 of –WM1: 0 – 4 VDC
3	Current converter at supply line 2 of –WM1: 0 – 4 VDC
4	Current converter at supply line 3 of –WM1: 0 – 4 VDC
5	Current converter at supply line 4 of –WM1: 0 – 4 VDC
6	Current converter at supply line 5 of –WM1: 0 – 4 VDC

7	Current converter at supply line 6 of –WM1: 0 – 4 VDC
8	Current converter at supply line 7 of –WM1: 0 – 4 VDC
-X4 (RJ45) – Analog inputs for the current converter evaluation for string current measurement	
Pin	**Signal description**
1	0V potential for the analog signals of the converters for string current measurement.
2	Current converter at supply line 8 of –WM1: 0 – 4 VDC
3	Current converter at supply line 9 of –WM2: 0 – 4 VDC
4	Current converter at supply line 10 of –WM2: 0 – 4 VDC
5	Current converter at supply line 11 of –WM2: 0 – 4 VDC
6	Current converter at supply line 12 of –WM2: 0 – 4 VDC
7	Current converter at supply line 13 of –WM2: 0 – 4 VDC
8	Current converter at supply line 14 of –WM2: 0 – 4 VDC
-X5 (RJ45) – Analog inputs for the current converter evaluation for string current measurement	
Pin	**Signal description**
1	0V potential for the analog signals of the converters for string current measurement.
2	Current converter at supply line 15 of –WM2: 0 – 4 VDC
3	Current converter at supply line 16 of –WM2: 0 – 4 VDC
4	Analog-input 17: freely available.
5	Analog-input 18: freely available.
6	Analog-input 19: freely available.
7	Analog-input 20: freely available.
8	Analog-input 21: freely available.
-X6 (RJ45) – Analog inputs for the current converter evaluation for string current measurement	
Pin	**Signal description**
1	0V potential for the analog signals of the converters for string current measurement.
2	Analog-input 22: freely available.
3	Analog-input 23: freely available.
4	Analog-input 24: freely available.
5	Analog-input 25: freely available.
6	Analog-input 26: freely available.
7	Analog-input 27: freely available.
8	Analog-input 28: freely available.
⑧	**PE bus bar (in the Central-Box base)**
Screw terminal	**Signal description**
1 to 10	Up to 10 screw terminals can be sticked to the PE bus bar for the necessary PE connections.

Table 5: Central-Box Minus – Terminal description

Note:
Observe tightening torque !

The torque of the individual lines mentioned below has to be observed during connection. See Table 4: Central-Box – Cable cross sections and torques.

4.3.2.1 Configuration of the PSC 1.1

Note:
PSC 1.1 adapter board !

1. Not used inputs has to be connected with groung during connection of the PSC 1.1 adapter board.
2 The freely available analog inputs have to be connected from the bottom to the top.

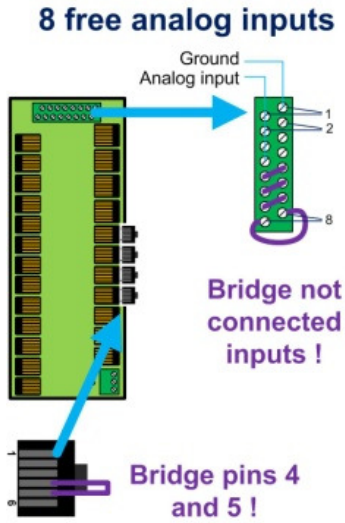


Figure 8: Bridge analog inputs

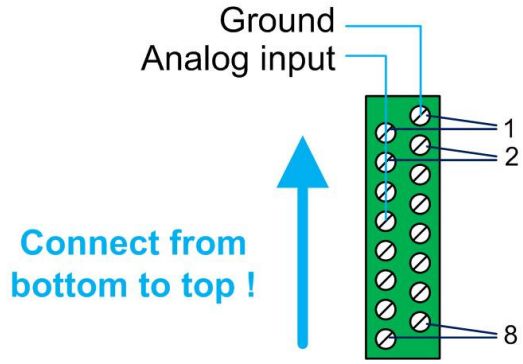


Figure 9: Connect analog inputs from bottom to top

4.3.3 Mounting rail for cable strain reliefs

Both following figures show the rail by which the strain relief of the supplied and led away lines can be realized.

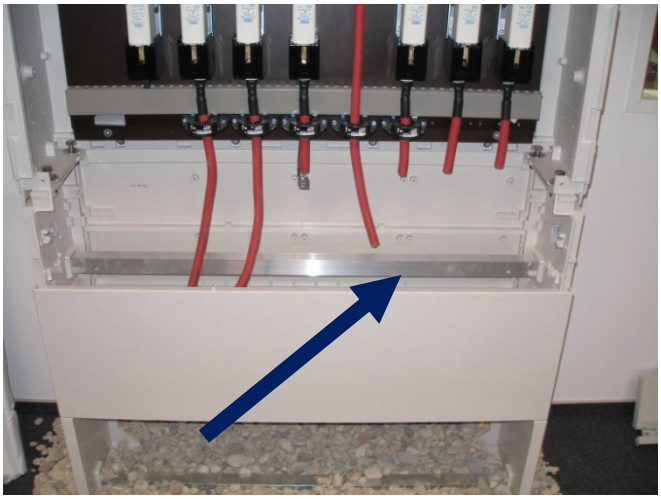


Figure 10: Central-Box – Mounting rail

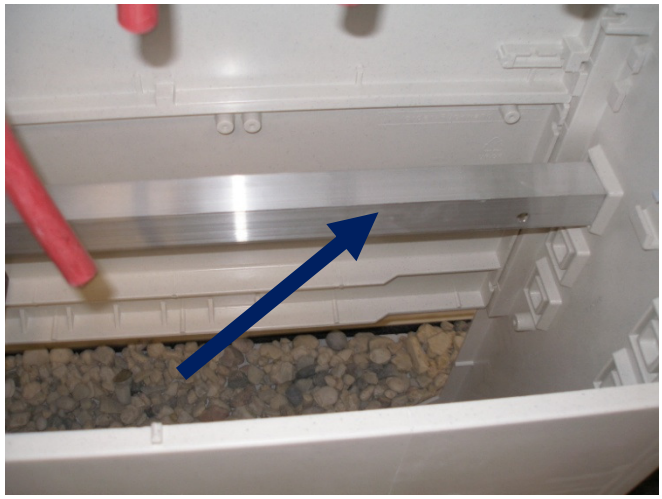


Figure 11: Central-Box – Strain relief

5. Function

5.1 The Central-Box collects supply lines from the TGA-Boxes Pro

The PADCON Central-Box is an array combiner used as a device for collecting of the individual supply lines from the TGA boxes of the photovoltaic plant. The DC supply lines collected in the Central-Box are led to the inverter via a collecting main.

5.2 The Central-Box fuses the supply lines against fault current

Additionally the individual supply lines (plus and minus) are fused in the Central-Box by NH1 fuses against overcurrent, reverse current and earth fault current.

5.3 The Central-Box protects PV plants against surge voltage on the DC side

The Central-Box protects the PV plant against surge voltage with help of surge arresters. 4 message windows are placed on the 4 surge arresters (2 Central-Box Plus, 2 Central-Box Minus) used in the Central-Box that indicate the state of the surge arresters. A green message window indicates that the surge arrester is operational. A red message window indicates that the surge arrester is out of operation. That means that an incorrect surge voltage occurred, that the surge arrester has tripped and has to be changed.

5.3.1 Evaluation of the surge arresters of the Central-Box

The surge arrester of the Central-Box is evaluated by a remote signal contact (ncc).

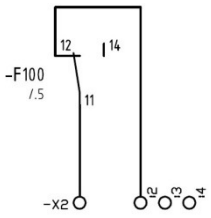
Surge arrester – Remote signal contact		
	**Status**	**Beschreibung**
	Contact closed	Operational
	Contact opened	Inoperative when one of the message windows indicate red !

Table 6: Remote signal contact

Additional for evaluation of the surge arrester states message windows are placed on the 6 surge arrester modules, that indicate the state of the corresponding modules. See **6.5 Protection against surge voltages**.

5.4.1 String current measurement

The Central-Box is used for string monitoring. The current of each individual string is measured for this purpose by a current converter in the Central-Box Minus and the analog measured value is transmitted into the Sensor-Box. The measured values are digitized in a cRIO controller in the Sensor-Box and transfered via the communication line into the control station of the photovoltaic power plant.

Figure 12: Evaluation of the current measurement in the Sensor-Box illustrates the interconnection the string current measurement in the Central-Box Minus and the transfer respectively the further processing of the measured current value.

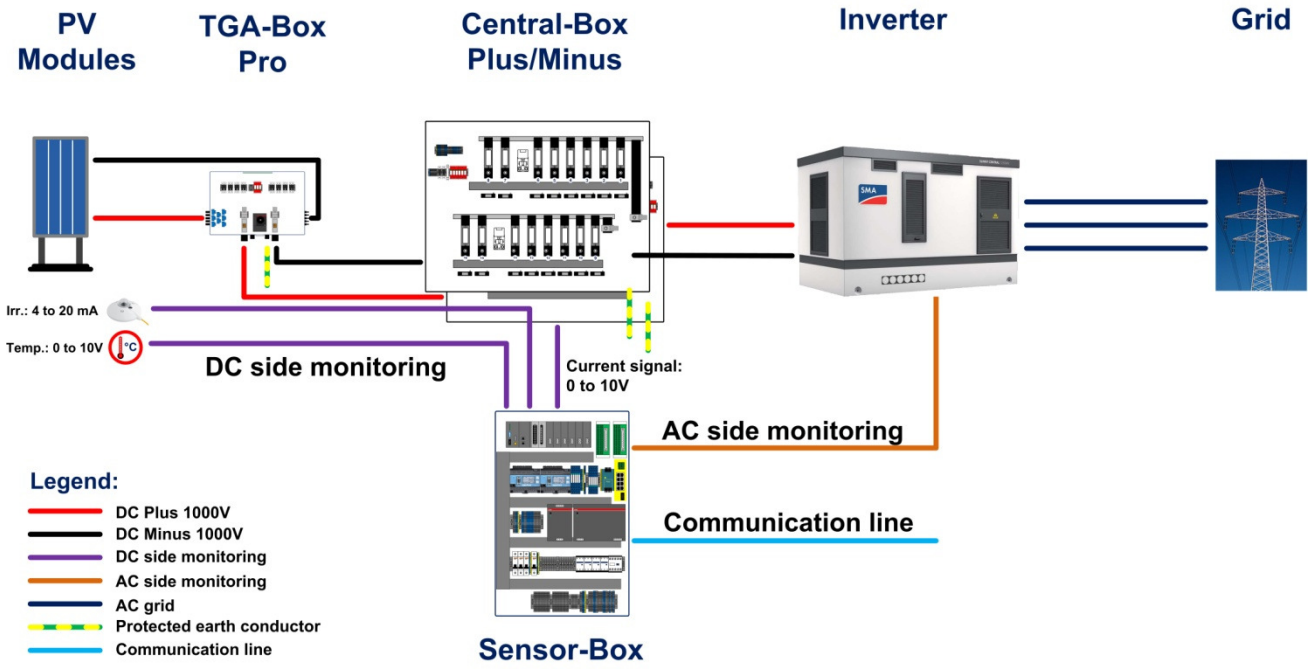


Figure 12: Evaluation of the current measurement in the Sensor-Box

Besides the voltage of the collecting mains also the current of the 16 supply lines (from the TGA-Boxes) is monitored in the Central-Box Minus. The measured values of the monitored current are made available at terminal –XM1.

Current monitoring in the Central-Box Minus	
Tap	1 current converter per supply line (= 16 current converters)
Input current value range	0 to 100 ADC
Measured signal value range	0 to +4 VDC

Table 7: Current monitoring – Signal evaluation

5.4.2 Evaluation of the voltage monitoring

The voltage applied to the collecting mains in the Central-Box Plus and the Central-Box Minus is monitored with a sensor and the measured value is made available at terminal –XM1. The plus potential of the voltage is measured at –WP1 in the Central-Box Plus. The minus potential of the voltage is measured at –WM1 in the Central-Box Minus. A connection is established between Central-Box Plus and Central-Box Minus for voltage measurement.

The both monitored voltage potentials are (i.e. the plus and the minus pole of the voltage measurement):

- The voltage at the collecting main of terminal –WP1 of the Central-Box Plus.
- The voltage at the collecting main of terminal –WM1 of the Central-Box Minus.

This voltage is converted in the Central-Box Minus with the help of a voltage converter and the measured value is made available at terminal –XM1. For the voltage measurement a line is led from terminal –WP1 of the Central-Box Plus into the Central-Box Minus.

Figure 13: Central-Box – String voltage measurement gives a basic overview of the string voltage monitoring, that is measured between the collecting mains of the Central-Box Plus and the Central-Box Minus.

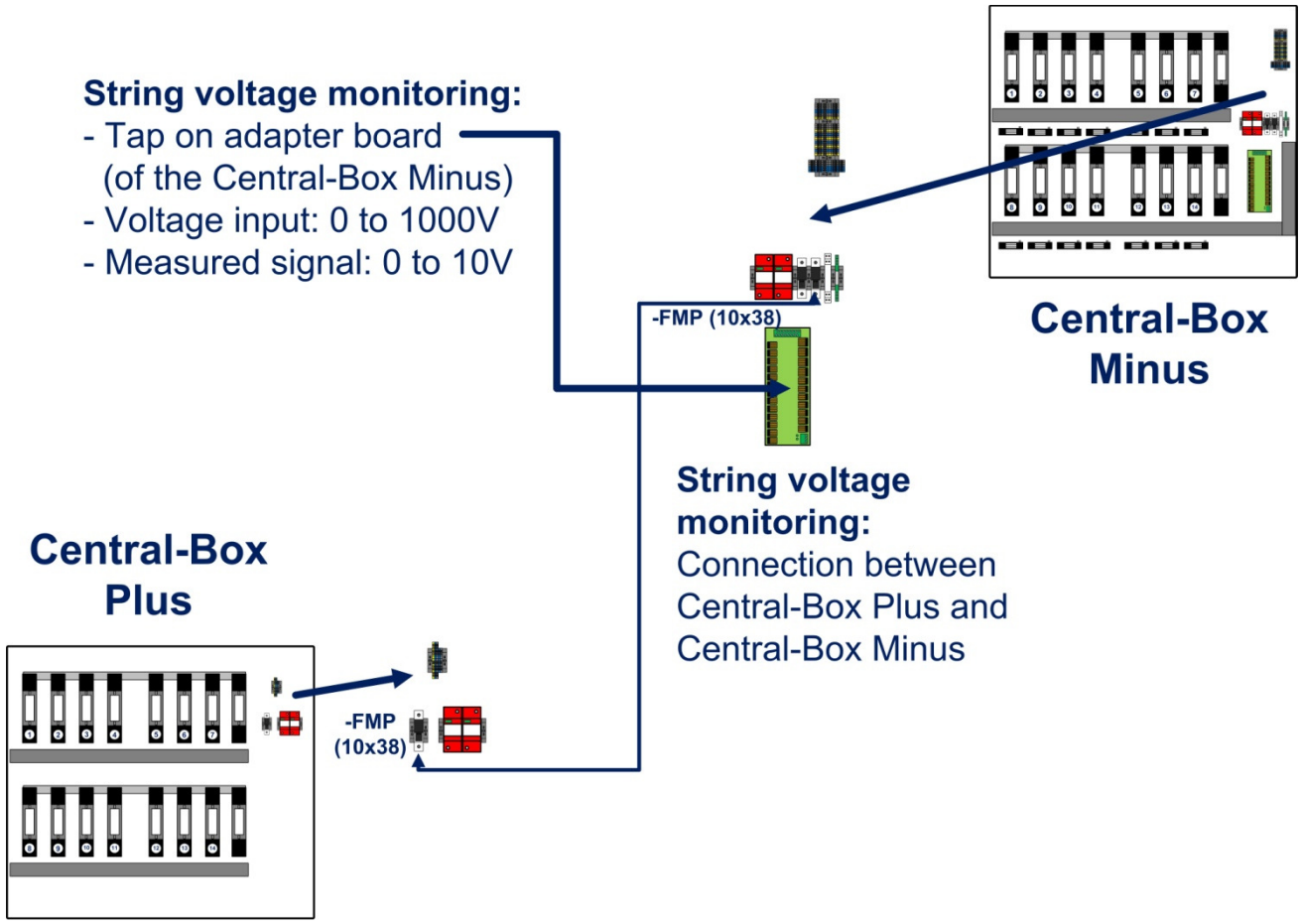


Figure 13: Central-Box – String voltage measurement

Voltage monitoring of the collecting mains	
Central-Box Plus	
Tap	Collecting main terminal –WP1
Input voltage value range	0 bis 1000 VDC
Measured signal value range	0 bis +10 VDC
Central-Box Minus	
Tap	Collecting main terminal –WM1
Input voltage value range	0 to 1000 VDC
Measured signal value range	0 to +10 VDC

Table 8: Voltage monitoring – Signal evaluation

6. Function check

6.1 General checks

6.1.1 Visual check

- Completeness of wiring
- Snap in of the clips
- Proper input wiring
- Proper fit of connectors
- Possible danger for man and material

6.1.2 Mechanical check

- Tight fit of fuses
- Tightening torque of cable glands

6.1.3 Electrical check

- Check correct string assignment
- Appropriate string current flow . See **7. Fault analysis / Decommissioning**.
- Appropriate open circuit voltage. See **7. Fault analysis / Decommissioning**.

6.2 Check of the plus and minus string fuses

6.2.1 Visual check

- Visible damages in and outside of the housing
- Proper installation of the fuses
- Surge arrester indicator on „Green“

6.2.2 Electrical check

- Current flow via earth
- Current flow/current direction

6.3 Collecting function of the Central-Box

6.3.1 Visual check

- Function of the string fuses
- Proper connection of the inputs
- Proper connection of the outputs

6.3.2 Mechanical check

- Proper sealing of the cable glands
- Firm hold of the connection / the connection terminal

6.4 Electrical check

- Polarity of current direction
- Compare input and output current

6.5 Protection against surge voltages

6.5.1 Visual check

The Central-Box protects the PV plants against surge voltages on the DC side. Message windows are placed on the surge arresters, that indicates the states of the surge arrester.

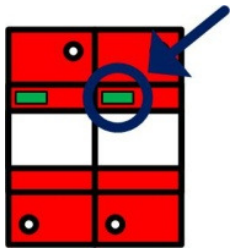
Surge arrester – Message window		
	**State / Color**	**Description**
	Green	Operational.
	Red	Inoperative if <u>one</u> of the message windows indicates red !

Table 9: Message window

The surge arrester has to be replaced if one of the 4 surge arresters (2 Central-Box Plus, 2 Central-Box Minus) of the Central-Box has tripped, to guarantee surge protection furthermore. See **7. Fault analysis / Decommissioning**.

- Message window state
- Proper connection of the surge arrester
- Possible danger for man and material

6.5.2 Electrical check

- Earth fault current
- Voltage applied to the surge arrester

6.6 Disconnection function between inverter and PV plant

- Function of the string fuses
- Function of the surge arrester

7. Fault analysis / Decommissioning

7.1 Fault analysis

Fault analysis	
Visual inspection	
Fault description	**Measure**
Damage of the housing.	The housing has to be changed.
Damage of the cable glands.	The cable glands have to be changed.
Damage of the cables.	The cables have to be changed.
Damage of the NH1 fuse bases.	The NH1 fuse bases have to be changed.
Damage of the terminal blocks.	The terminal blocks have to be changed.
Damage of the PSC1.1 adapter board.	The PSC1.1 adapter board has to be changed.
Voltage check	
Nominal voltage nonexistent.	The wiring has to be checked.
Polarity reversal.	Correct polarity.
Current check - Polarity	
The current of the inputs must be equal to the output current.	The wiring has to be checked.
Polarity reversal.	Correct polarity.
Ground fault error – Insulation fault	
Ground fault error.	Check if the attached voltage is higher than 1000 VDC. If not, replace the surge arrester.

Table 10: Fault analysis

7.2 Decommissioning and demounting of the Central-Box

Danger:
Danger of life by electrical shock !

High DC voltages are attached to the different components of the Central-Box.

- All works described in this manual must exclusively be executed by qualified technical personal. Qualified means that the personal has to be trained corresponding the task that has to be executed.
- All safety instructions mentioned in the user's manual have to be obtained working on the Central-Box. The personal has to be familiar with the content of the user's manual.
- If you can not repair an error with help of this manual, immediately contact PADCON.

1. Disconnect the inverter on the AC side.
2. Switch the inverter currentless on the DC side.
3. Disconnect the outputs of the Central-Box from the equipment.
4. Disconnect the inputs of the Central-Box from the generator.
5. Disconnect the earthing.
6. Demount the Central-Box.

8. Safety instructions

General

1. **The Central-Box only must be opened and installed by trained electrotechnical specialists**
2. **Consider the installation instructions in this manual**
3. **Consider the installation instructions of the used inverters and other connected devices**
4. **Consider the standards and rules as**
   - **BGV A1/A2: Common trade association safety instructions for electrical installations / equipment**
   - **DIN VDE 0100-712: Solar photovoltaic power supply systems (requirements for industrial premises, rooms and plants)**
   - **VDI 6012 VDI Guide line: Decentralised energy systems in buildings, photovoltaic**
   - **IEC 62548/ IEC82/514/CD: Installation and safety requirements for photovoltaic (PV) generators**
   - **DIN VDE 0100-534**
5. **Inspect the Central-Box for damages before installation, that can prevent the functional and safety operation of the Central-Box**
6. **In case of violation of the installation instructions mentioned in this manual expires the warranty and the liability**

Validity

This documentation describes how to install and operate a Central-Box.

Target group

This documentation is intended for installers and operators of PV systems which are realized with the Central-Box. It includes a description of how to install, operate the Central-Box.

Explanation of the Symbols Used

In this document, the following terms and symbols are used to describe different hazard levels:

Danger

Danger indicates a hazardous situation which, if not avoided, will result in death or serious injury.

Warning

Warning indicates a hazardous situation which, if not avoided, could result in death or serious injury.

Caution

Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

Storage of documentation

This operating manual, the installation guide, the data sheets, the operating manuals of installed components, and the wiring diagrams must be kept in the immediate vicinity of the Central-Box. They must be available to operators and maintenance staff at all times.

Failures and correction

Failures that can affect the safety, have to be removed immediately. Impermissible change and the use of spare parts, that are not recommended from PADCON can cause fire, material damage or electrical shocks. Unauthorized persons must nut have access to this devices. Instruction labels have to be readable properly and have to be replaced immediately if damaged.

Appropriate usage

Appropriate use of the Central-Box means following all instructions in the installation manual relating to installation, electrical connection, and commissioning of the equipment. Any deviation from the instructions in this manual is regarded as inappropriate use of the equipment. PADCON accepts no responsibility or liability for any and all damage resulting from inappropriate use of the equipment.
Appropriate use of the equipment also entails:
• Observation of the safety instructions listed here and in the following sections
• Observation of the instructions in the user manual
• Conformance to the device-dependent technical data

Personnel

Only qualified technical personnel may perform any and all work on the Central-Box. Qualified means that the personnel must possess training relevant to the activity performed and must be familiar with the content of this manual. The personnel must have read and understood the safety section in this manual.

About this manual

This manual was written with the greatest possible care. However, discrepancies cannot be excluded. PADCON accepts no responsibility or liability for injury to persons, or material damage caused by mistakes in this manual.

Checking the delivery

Upon receipt of the equipment, check the packaging and the device for any possible damage and compare the contents of the delivery with the delivery documentation. In the case of damage to the device and/or unclear delivery contents, please immediately contact PADCON GmbH (see contact address on the last page).

Storage

The PADCON Central-Box may only be stored in rooms protected from dust and moisture.

Installation

The requirements relating to the installation site, the manner of installation and the mounting position must be observed. In addition to this, the following points must be noted.

- The installation location must be easily accessible and offer a secure base for working on the device. This is especially important for roof-mounted systems.
- The Central-Box is built using the latest technology, according to recognized safety standards. Despite this, a fault resulting in arcing cannot be ruled out. This can result in melting of the enclosure as well as fire and smoke, which may represent a hazard to personnel or equipment. This must be taken into consideration upon installation.
- The equipment may not be installed near to inflammable materials. If this cannot be avoided, preventative measures must be taken, which prevent fire and smoke from spreading.
- The equipment may not be installed in critical areas, escape routes, living spaces or office spaces.

Special Hazards of Photovoltaic Systems

Photovoltaic systems have special characteristics representing special hazards that are described here. An active power source is connected, which means that depending on the operating mode there may be voltage present, from the photovoltaic generator and/or the Central-Box. This is especially important to note when disconnecting the Central-Box. High DC voltages are connected (no zero-crossing), that in case of error, or unproper use of fuses or connectors, may result electric arcs. The short-circuit current of the photovoltaic generator is only slightly higher than the maximum operating current and is also dependent on the level of solar radiation, which means that if a short circuit occurs in the system, the existing circuit breakers are not guaranteed to switch off. A highly branched generator array may be difficult to disconnect if a fault develops (e.g. short circuit). We recommend the additional use of the optionally available DC circuit breaker for disconnecting the inverter.

Changes, modifications or additions of the Central-Box

Danger:
Danger in case of changes, modifications or additions of any components of the Central-Box !
No changes, modifications or additions of any components of the Central-Box are allowed without prior agreement of Padcon.

9. Maintenance

Danger:
Danger to life by electric shock !

High DC voltages are applied to different components of the Central-Box:

- All operations described in this chapter excludedly may be led through by qualified technical personal. Qualified means that the personal is trained appropriately to the task.
- All safety notes mentioned in the user's manual have to be observed during operations at the Central-Box.
- If you are not able to remove an error with help of this manual, please immediately contact PADCON.

Following table gives an overview of the different maintenance working that have to be led through at the Central-Box and the recommended maintenance interval.

Central-Box - Maintenance	
Maintenance working	**Maintenance interval**
Check the terminal clamps of the power wiring for solidity and retighten if required. Visually check the insulation and the terminals. Thereby look after changes and discoloring of the material. Immediately change defect or corroded lines and contacts.	12 month
Check the terminal clamps of the string wiring for solidity and retighten if required. Visually check the insulation and the terminals. Thereby look after changes and discoloring of the material. Immediately change defect or corroded lines, contacts and connectors.	12 month
Check the correct and horizontal mounting of the Central-Box.	12 month
Check the locks of the cover of the Central-Box for free movement and correct function.	6 month
Check the cable glands for tightness and firm fit. Immediately change defect or untight cable glands.	6 month
Check if condensed water has accumulated in the Central-Box.	6 month
Check the earth connection respectively the contact resistance of the protective conductor.	12 month
The function of the voltage converter has to be checked.	12 month
The wiring of the voltage converter has to be checked.	12 month
The function of the current converters has to be checked.	12 month
The wiring of the current converters has to be checked.	12 month
Check the ventilation membrane for pollution respectively damage. Immediately change a defect or damaged ventilation membrane.	12 month
Check the fuses after removal from the fuse holders.	12 month
Check the surge arresters of the Central-Box.	12 month
Check the DC contactors for proper function.	12 month
Check the mounting place of the Central-Box for easy access, secure stand and flammable materials.	12 month

Table 11: Central-Box maintenance

10. Spare parts

Following spare parts are available for the Central-Box:

- Fuse
- Fuse base
- Cable gland
- Housing lock
- Tools

11. Service / Contact

PADCON GmbH
Steigweg 24, Gebäude 44
97318 Kitzingen
Germany
Tel: +49 (0) 9321.2680-200
Fax: +49 (0) 9321.2680-9200
E-Mail: info(at)padcon.com
www.padcon.com

Service and Complaint

Your primary point of contact for any service issues is Sascha Machner with his competent team.

Tel: +49 (0) 9321.2680-222
e-mail: service(at)padcon.com